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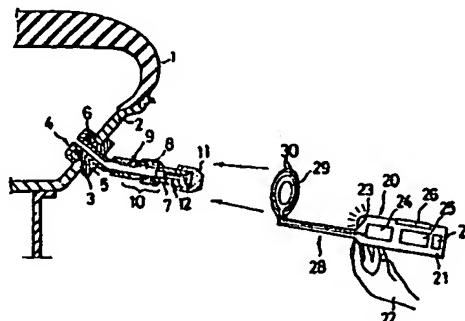
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54 Tire inspection device.

EP 0 301 443 A1
 57 The present invention provides a device for inspecting the pressure, temperature, etc. in the tire (1) and which is composed of a pressure sensor (9) attached to the valve (4) fixed to the tire fixing rim (2) and of which the output varies depending upon the tire internal pressure and a resonator (10) including a resonant coil (8) which resonates with an external radiation electromagnetic wave and a capacitor. The oscillation coil (30) of an oscillator (24) which generates the above-mentioned radiation electromagnetic wave is installed as projected from the main body (20) in which the main body (20) of the inspection device comprises a signal processor (25) which detects and processes any change in oscillation state which has taken place at the oscillator as

caused by the resonance state of the resonator (10) and a display (26) to display the result of the processing made at the signal processor (25).

FIG. 1



TIRE INSPECTION DEVICE

Background of the Invention:

Field of the Invention:

The present invention relates to a tire inspection device quite suitable for checking the tire internal pressure and detecting the temperature in the tire, the strain of the tire wheel and the like.

Description of the Prior Art:

As the conventional mean of detecting, for example, the tire internal pressure (air pressure), known are device are devices a means of detection fitted on the tire side and having which utilizes the electromagnetic induction, electromagnetic resonance etc. to detect the tire internal pressure even while the automobile is running. They are of the so-called the non-contact system. Besides, other devices are known which transmit the tire internal pressure through the slip ring, ejection rod or the like. They are of the so-called contact system. The tire internal pressure detections of the non-contact system among them are complicated, and so need high manufacturing costs. Further, the wheels especially made for this system, the modification, etc. of automobiles are required as well. Furthermore, the maintenance of their reliability and environmental durability is difficult. And, what is more, the cost increase is obliged to solve these problems.

In addition, the display-type tire internal pressure detections have hitherto been developed as a low-cost means. However, when they break down, the tire internal pressure is released to the air due to their original construction.

And the detective operation is apt to occur under the low temperature during the winter season due to freezing. Therefore, they have problems in reliability and safety, so they have not yet attained the stage of the practical use.

Moreover, of any tire internal pressure detections, the tire valves are merely manufactured for the purpose of filling the tire with air and maintaining the airtightness, and have not the structure meeting the purpose of detecting the pressure and temperature in the tire.

As described above, various tire pressure internal detections have been developed. However, no

contrivance has been made to the tire valves employed for them. Above all, no fully satisfactory tire pressure detections have been developed yet to date.

Brief Summary of the Invention:

This invention aims at providing the tire inspection device quite suitable for the detection of the tire internal pressure and temperature in the tire, the strain of the wheel and the like.

In order to achieve the above-mentioned object, this invention consists roughly of the two units: one unit, which is fitted to the valve fixed to a tire fixing rim, is composed of the sensor of which output changes depending on the tire internal pressure and the temperature in the tire, etc.; and the resonance part containing a condenser and a resonance coil which resonates to the radiant electromagnetic waves reaching from outside. The other unit, which is the portable main body of the said tire inspection device, is composed of the oscillator, which generates the above-mentioned radiant electromagnetic waves; the oscillating coil projected from the said main body; the signal processing part which detects and processes the change of oscillating conditions produced in the said oscillator caused by resonance condition in the above-mentioned resonance part which changes according to the afore-mentioned tire internal pressure, temperature, etc.; and the display displaying the processed result to the outside.

This invention makes it possible that: when the oscillating coil projected from the portable main body of the inspection device is brought near the resonance part fitted to the valve fixed to the rim, the resonance condition changes according to the value detected by the sensor in the resonance part. Then, the change of the resonance condition is detected, and after signal processing, it is displayed in the display.

Brief Description of the Drawings:

Figure 1 is a schematic drawing of the overall tire inspection device of this invention; Figure 2 is a block diagram showing the composition of the electric circuit of the said device of this invention; Figure 3 to Figure 5 are electrical performance views of the said device of this invention; Figure 6 is a cross-sectional view showing an example of the tire valve utilized for this invention; Figure 7 is a cross-sectional view of the cap; Figure 8 is a

block diagram of a composition example of the said device using the tire valve shown in Figure 6; Figure 9 is a perspective view of the main body of the said device; Figure 10 is a cross-sectional view of other example of the tire valve utilized for this invention; Figure 11 is a brief sectional view of another tire valve; Figure 12 to Figure 20 are sectional views of tire valves showing examples of variety of shapes, formed portions, etc. of the first and second electric conductors as well as the insulated parts; Figure 21 is a sectional view of other example of the tire valve used for this invention; Figure 22 is a sectional view of the cap; Figure 23 is a block diagram of the said device; Figure 24 is a sectional view of the valve core of the short type used for this invention; and Figure 25 is a sectional view of the axis utilized for the valve core shown in Figure 24.

Description of the Preferred Embodiment:

In the following, the tire inspection device of this invention will be explained on the basis of illustrated embodiments:

In Figure 1, a tire 1 is fixed to a tire fixing rim 2, and a hole 3 for fitting a valve 4 is made on a slant of the rim 2. In order to seal up the gap, an O ring 6 is inserted inside the base end of the valve 4 of which cylindrical circumference is threaded so that the air does not leak from the above-mentioned hole 3. From the side around the outer end of the valve 4, the valve fixture 5, of which inside is threaded, is inserted and screwed on so that the valve 4 is tightly fixed to the rim 2 in sealing up the air. A slender cylinder 7 housing the resonance part is screwed and fixed to the outer end of the valve 4. And a cap 11 is screwed to the end of the cylinder 7 to prevent the intrusion of mud, etc.

The coil 8 is wound suitable times around the middle part of periphery of the cylinder 7, and pressure sensor 9, which turns on and off depending on the tire pressure volume, is fitted onto the hollow of inner wall of the cylinder 7, and is located near the coil 8.

In addition, a rubber packing 12 acting as a valve in case of entry and escape of the air is attached to the end of the cylinder 7.

In the following, the composition of a main body 20 of the tire inspection device of this invention will be described:

As shown in Figure 1, the main body 20 is a slender rectangular parallelepiped which can be held in one hand 22, and a light 23 is mounted on the side slant of the front part so that one can, for example, clearly see the valve 4 and the like even in the dark. Also, furnished is a display 26 on the main body 20 so that when the tire internal pres-

sure holds the proper value, a green lamp lights, and when it is less than the proper value, a red lamp lights in the said display.

Moreover, a detective rod 28 projects from the front part of the main body 20. And fitted to the front end of the detective rod 28 is a ring 29 with a round hole in the center, so the said ring 29 can be inserted to the outside of the resonance part 10. Also, an oscillating coil 30 is furnished in the ring 29 in the form of widening the above-mentioned hole, and is connected to an oscillator 24 housed in the main body 20, and the oscillator 24 is connected to a signal processing part 25. Furthermore, a battery 27 which is the power source of the above-mentioned light 23, the oscillator 24, etc., are housed in a casing 21 of the main body 20.

The block composition of the electric circuit of the tire inspection device of this invention will be described with Figure 2 in the following:

The pressure sensor 9, a condenser 13 and a coil 8 are connected in parallel in a resonance part 10 set on the tire side. And, for example, the pressure sensor 9 turns on and off according to the volume of the tire pressure. In addition, a resistor 14 for adjusting the characteristic is arranged between the pressure sensor 9 and the condenser 13.

On the other hand, the main body 20 of the tire inspection device consists of such component parts as the oscillator 24 containing the oscillating coil 30 and the signal processing part 25 detecting the output of the oscillator 24 and performing the comparison, etc.

In addition, the display 26 containing the green and red lamps lights up according to the output of the signal processing part 25 to inform the inspection results to one who conducts the inspection.

In the following, how to use the tire inspection device of this invention will be described:

As shown in Figure 1, the ring 29 of the main body 20 is, at first, inserted to the outside of the resonance part 10, which is fitted to the rim 2 of the automobile (not illustrated), with the power source switch of the main body 20 turned on.

Thereupon, in case the tire internal pressure holds, for example, the proper value, the pressure sensor 9 turns on, and the green lamp of the display 26 lights due to the function of electric circuit mentioned below.

Contrarily, in case the tire pressure is lower than the proper value, the pressure sensor 9 turns off, and the red lamp of the display 26 lights, indicating the pressure is below the proper value.

In the following, the performance of electric circuit of the tire inspection device of this invention will be explained with Figure 3 to Figure 5:

Figure 3 shows the wave form of the oscillating current indicating the oscillating condition of the oscillator 24, while Figure 4 shows the condition

that the oscillating current of the oscillator 24 changes with the approach to the resonance part 10 set on the wheel side. The wave forms shown with A in the said figure indicate the condition that the resonance part 10 and the oscillator 24 part with each other locationally and that the latter is not affected by the resonance part 10. Also, the wave form shown with B indicates that, when the resonance part 10 approaches to the oscillating coil 30 of the oscillator 24, the electric current in the oscillator 24 becomes abnormal as the oscillating energy is absorbed into the resonance part 10, and, as a result, the amplitude of the oscillating current becomes almost zero.

The signal processing part 25 detects and makes, as mentioned above, the comparison, etc. of the change in the output signal from the oscillator 24, and outputs the H level signal in proportion to the interval of width corresponding to B as shown in Figure 4, and makes the green lamp of the display 26 light in proportion to the interval of the H level shown in Figure 5.

On the contrary, in case the tire pressure is lower than the proper value when the ring 29 of the main body 20 is inserted to the outside of the resonance part 10, the pressure sensor 9 (see Figure 2) remains in "off" condition, so the resonance part 10 does not form the closed loop. Accordingly, when the ring 29 of the main body 20 approaches to the resonance part 10, the output of the oscillator 24 remains as shown in Figure 3. Therefore, the H level signal as indicated in Figure 5 does not occur. In such a case, the red lamp of the display 26 lights, and warning is given to inform that the tire internal pressure is below the proper value.

As described above, the inspection device can be simply composed by this invention, and the inspection method becomes quite easy. In addition, the tire inspection device of this invention makes the remodeling of automobiles, rims, etc. unnecessary as the oscillator, display, etc. are installed. Besides, the resonance part is only fitted to the tire valve, so the aforesaid environmental conditions are not severe, and the high reliability can be obtained.

Hitherto, the number of oscillators and displays (that is, the main body of the tire inspection device) has been required as many as the member of tires of the automobiles, whereas this invention requires the minimum necessary number of main bodies of the inspection devices regardless of the number of tires. Needless to say, truck, bus and taxicab companies, etc. are required to control the tire internal pressure of their motor vehicles. In such cases, even if they possess a great many motor vehicles, if they employ the inspection devices of this invention, a very few main bodies of the said devices

will meet the requirement, and they can carry out the collective control system of the tire pressure, etc. at a low expense.

Although these companies are required to make some adjustment to maintain the accuracy of the displays of the main bodies of the said devices, thanks to a small number of the main bodies, they can reduce the cost required for the adjustment.

In general, concerning the vehicles particularly driven on muddy roads, in a cold district, etc., surroundings of the valves are likely to become very dirty with mud, etc. or to be adhered with mud. Even in case that mud and the like freeze to the surroundings in the winter season, as long as the tire inspection device of this invention is utilized, the inspection can be conducted with ease, because the removal of the valves, etc. are not required.

In case of checking inner tires of dual wheels of large automobiles such as buses, the checking by the said device of this invention can be easily done as the oscillating coil can be simply brought near the tips of the tire valves.

The pressure sensor in the examples of this invention indicates whether the tire pressure holds the proper value or not by on-off action of the switch. However, other pressures sensors that the resistance value changes analogously according to the tire pressure volume as in the case of, for example, the variable resistor may be employed. In this case, the tire internal pressure may be indicated in detail in the display 26 of the said main body. For example, if a liquid crystal display means is used, the tire pressure condition can be seen more precisely.

Next, the valve 4 of an optimum structure for measurement of the pressure and temperature in a tire will be described with reference to Fig. 6 and subsequent Figures.

Referring now to Figure 6, a valve stem 41 of the valve 4 made of a conductive material (usually, brass) is formed from a first conductive member 41A and second conductive member 41B electrically isolated from each other by means of an insulative member 42 made of an insulator. A sensor 43, for example, pressure sensor, is provided on the end of the valve stem 41 and connected at the one side thereof to the first conductive member 41A and at the other side to the second conductive member 41B. In the embodiment shown in Fig. 6, the cap 44 of the valve stem 41 incorporates an electronic circuit 45 of which a signal wire 46 is connected to the first conductive member 41A and the other signal wire 47 is connected to the second conductive member 41B. Thus, when the cap 44 is attached to the valve stem 41, a signal from the sensor 43 can be received by the electronic circuit 45 through the first and second conductive mem-

bers 41A and 41B as lead wire and processed for display. The detail of the cap 44 incorporating this electronic circuit 45 is shown in Figure 7. This cap 44 is also made of a conductive material. The base end of the first conductive member 41A insulated by the insulative member 42 is in contact with the signal wire 46 while the base end of the second conductive member 41B is in contact with the signal wire 47. In case the tire inspection system is built using the tire valve 4 shown in Figures 6 and 7, it can be constructed, for example, as shown in Figures 8 and 9. That is, the sensor 43 provided at the end of the valve stem 41 is connected to the electronic circuit 45 by means of the first and second conductive members 41A and 41B serving as lead wire, and the electronic circuit 45 is provided thereon with a capacitor 14 and coil 8, forming as a whole a resonator 10. The main body 20 of the inspection device comprises a cylinder 31, oscillating coil 30 provided in the cylinder 31, and an oscillator 24 to which the oscillating coil 30 is connected. The oscillator 24 is connected to a signal processor 25 which is connected to a display 26. A lamp 23 and a battery 27 feeding the oscillator 24, etc. are housed in a casing 21. The lamp 23 is provided to illuminate the valve 4 in a dark place or at night for easy setting the cylinder 31 on the valve 4. The display 26 lights blue when the detected tire internal pressure, etc. are appropriate, but it lights red if the detected values are inappropriate. In the embodiment shown in Figure 9, the cylinder 31 is used in place of the ring 29 in Figure 1. Of course, however, the ring 29 may be used.

Figure 10 shows an embodiment of the tire valve. In this embodiment, the electronic circuit 45 is not incorporated in the cap 44, but in a member (such as nut or the like) fixed to the valve stem 41. The reference numeral 48A indicates a thread.

Figure 11 shows another embodiment of the tire valve in which a combination of the sensor 43 and electronic circuit 45 is installed inside the tire 1, namely, to the rim 2 of the wheel and the signal wires 16 and 17 are connected to the first and second conductive materials 41A and 41B, respectively.

Figures 12 thru 20 show other embodiments of the tire valve different in location of the insulative member 42 from one another. In Figure 12, the insulative member 42 insulating the first and second conductive members 41A and 41B from each other is not straight in the axial direction but so stepped at an intermediate point (indicated with I in Figure) that the first conductive member 11A is thinner at the free end side thereof (in the tire) than at the base side (at the cap side). Thus, when the first conductive member 41A is pressed from the base side thereof, it will not be separated from the

second conductive member 41B. In Figure 12, the reference numeral 3 indicates a valve fixing nut (fixing member), 3A a valve washer and 18 an insulative packing provided between the rim 2 and the valve stem 41. In the embodiment shown in Figure 13, the second conductive member 41B is fixed to the first conductive member 41A by calking the second conductive member 41B at the ends (indicated with II in Figure 13) of these conductive members 41A and 41B, and an insulative member 42 is formed along the calked portion. Because of this calking, the first and second conductive members 41A and 41B are prevented from being displaced in the axial direction. Figures 14 thru 19 show further embodiments different in location of the insulative member 42 or in shape of the valve body 1 from one another.

In any of the aforementioned embodiments, the first and second conductive members 41A and 41B are made in a cylindrical form, respectively. As shown in Figure 20, however, the first and second conductive members 41A and 41B may be formed as semicircle in sectional shape so that they will form together a cylinder when attached to each other. The insulative member 42 may be placed as sandwiched between these conductive members.

For leading out electric signals the pressure, temperature, etc. detected by the sensor 43 or the like from inside the tire wheel through the first and second conductive members 41A and 41B, either of the contact and non-contact systems may be adopted.

As having been described in the foregoing, the tire valve in the inspection device has a valve stem made of a conductor composed of at least two conductive members, first and second, electrically isolated from each other by means of an insulative member made of an insulator for leading out as electric signals the pressure, temperature, etc. detected by the sensor or the like from inside the tire wheel through the first and second conductive members. Therefore, it is not necessary to specially work the wheel, and with either of the contact and non-contact systems to lead out such electric signals, the tire internal pressure or the like can be easily detected and a variety of inspection devices can be constructed at low costs.

Regarding the valve 24 shown in Figure 21, the valve stem 41 has a valve core 51 in it and is so designed as to be fixed to the rim 2 with a nut 3 (fixing member). The valve core 51 has a shaft 52 and a head 53 in which the shaft 52 is inserted and which is screwed in the inner circumference of the valve stem 41. The valve core 51 has provided below the head 53 thereof a body 54 on the other circumference of which a body packing 55 is provided to assure a sealing between the body 54 and the inner circumference of the valve stem 41. The

body 54 abuts at the lower end thereof a valve packing 57 provided around the shaft 52 and seated on a valve packing receiver 56. The head 53 is electrically connected to a spring holder 59 by means of the shaft 52 of the valve stem 41. Thus, the shaft 52 made of a conductor forms the first conductive member while the head 53 insulated from the first conductive member (shaft 52) by means of an insulative member 60, body 54, valve packing holder 56, spring 58, spring holder 59 and valve stem 41 form together the second conductive member. There is provided at the end of the shaft 52 a sensor 43 of which an electrode wire 61 is kept in contact with the inner surface of the spring holder 59 by means of a spring 62. The reason why the spring 62 is used to keep the electrode wire 61 in contact with the inner surface of the spring holder 59 is that as the top 52A of the shaft 52 is pushed down, the electrode wire 61 also moves along the inner surface of the spring holder. The sensor 43 detects the internal pressure, temperature, etc. inside the tire and such pressure, temperature, etc. can be led out as electric signals through the first conductive member (shaft 52) and second conductive member (head 53, body 54, valve packing holder 56, spring 58 and spring holder 59). The valve core 51 blocks the air in the tire when it is in the position shown in Figure 21, but when the top 52A of the shaft 52 is pushed down, the shaft 52 will push down the valve packing 57 and valve packing holder 56, whereby the sealing between the body 54 and valve packing 57 is released so that the air in the tire flows into the passage between the shaft 52 and body 54 and flows out through the clearance between the head 53 and shaft 52. Similarly, air can be injected into the tire.

An example of the process after the information detected by such sensor 43 is led out as electric signal through the first and second conductive members will be described with reference to Figure 22. The inspection of the tire internal pressure by the device according to the present invention will be explained under the assumption that the sensor 43 is a pressure sensor. The electronic circuit 45 is incorporated in the cap 44 screwed in the valve stem 41 and the signal wires 46 and 47 of the electronic circuit 45 are connected to the first and second conductive members, respectively. Thus, when the cap 44 is attached to the valve stem 41, a signal from the sensor 43 can be sent to the electronic circuit 45 through the first and second conductive members serving as lead wires, and the signal can be processed for display. The lead wire 46 is provided with a clip 63 made of a conductive material, which gets in contact with the top 52A of the shaft 52 being the first conductive member. Since the top 52A is not coated with any insulative

material, the signal on the shaft 52 being the first conductive member as lead wire from the sensor 43 can be sent to the electronic circuit 45 through the clip 63 and lead wire 46. The signal wire 47 permits the electronic circuit 45 to receive the signal sent from the sensor 43 through the valve stem 41. Therefore, in this embodiment, the valve stem 41 is also made of a conductive material to form a second conductive member. The electronic circuit 45 is provided in it with a capacitor 13 and coil 8 as in the embodiment shown in Figure 8, and forms as a whole an resonator 10. The main body 20 of the inspection device is constructed as in Figure 9. Figure 23 is a block diagram of the inspection device, similar to that shown in Figure 8.

It should be noted that the electronic circuit 45 may not always be incorporated in the cap 44 but it may be provided in a member installed in the valve stem 41. Also, not that the elements of the first conductive member and those of the second conductive member are not limited to those in the embodiments shown in Figures. Appropriate parts can be selected with a consideration given to the electrical connection with the electronic circuit 45 and sensor 43. The first and second conductive members have only to be electrically isolated from each other by means of an insulative member 60. Further, the present invention cannot only be applied to the straight valve having been illustrated and described in the foregoing but also to any curved or bent valve. Further, the conductive members are not limited only to the first and second ones but a third, fourth and further conductive members can be constructed.

Figures 24 and 25 show the valve core 51 and shaft 52 which are shorter. According to these embodiments, a spring 58 is incorporated in the body 54. Therefore, these embodiments needs any spring holder 59. Also in these embodiments, the body 54 and valve packing holder 56 are not shown as connected but a projection or the like is provided which gets in contact with either the body or valve packing holder. The body and valve packing holder are put into contact with each other by the projection to serve as lead wire through which electrical signal is sent.

For leading out as electric signal the pressure, temperature, etc. in the tire, detected by the sensor 43 or the like, from the inside the tire wheel through the first and second conductive members by using the sensor 43 or the like, either of the contact and non-contact systems may be adopted.

The tire valve constructed as having been described in the foregoing is composed of the parts forming at least the first member and those forming the second conductive member, selected arbitrarily among the plural parts made of a conductor and forming the tire valve core and which are elec-

trically isolated from one another by means of the insulative member made of an insulator to lead out as electric signals the sensor-detected pressure, temperature, etc. in the tire from the tire wheel inside through the first and second conductive members. Therefore, it is not necessary to specially work the wheel and it is easy to detect the pressure, etc. in the tire with either of the contact and non contact systems. Also a variety of inspection devices can be manufactured at low costs. The tire valve can be easily installed to either of the tube tire and tubeless tire. Further, the tube valve can be manufactured without any high techniques. That is, in case the valve stem must be worked, a high technique is required since the durability of the valve stem must be maintained. However, since the first and second conductive members consisting of the parts of the valve core have only to be electrically isolated from each other by means of an insulative member, the tire valve can be embodied at low costs. Also, the tire valve can be easily replaced similarly to the replacement of the ordinary valve core.

Claims

1. A tire inspection device, comprising:
a resonator including a sensor attached to a valve fixed in a tire fixing rim and of which the output varies depending upon the tire internal pressure and the temperature in the tire etc. coil which resonates with an external radiation electromagnetic wave and a capacitor;
a main body including a signal processor having an oscillator of which the oscillation coil generating said radiation electromagnetic wave is attached as projected from the main body and which detects and processes any change in oscillation state in said oscillation which has been caused by the resonance state of said resonator which varies depending upon the pressure, temperature, etc in said tire, and a display which shows the result of the processing.

2. A tire inspection device according to Claim 1, provided with a light which facilitates to set the device in dark place or at night.

3. A tire inspection device according to Claim 1, said tire valve comprising a valve stem, said valve stem being composed of at least two conductive members, first and second, electrically isolated from each other by means of an insulative member made of an insulator, thereby leading out as electric signals the tire internal pressure, temperature, etc. detected by a sensor or the like from inside the tire wheel through said first and second conductive members.

4. A tire inspection device according to Claim 1, said tire valve comprising a valve core, said valve core being composed of the parts forming at least the first member and those forming the second conductive member, selected arbitrarily among the plural parts made of a conductor and which are electrically isolated from one another by means of the insulative member made of an insulator, thereby leading out as electric signals the tire internal pressure, temperature, etc. detected by a sensor or the like from inside the tire wheel through the first and second conductive members.

FIG. 1

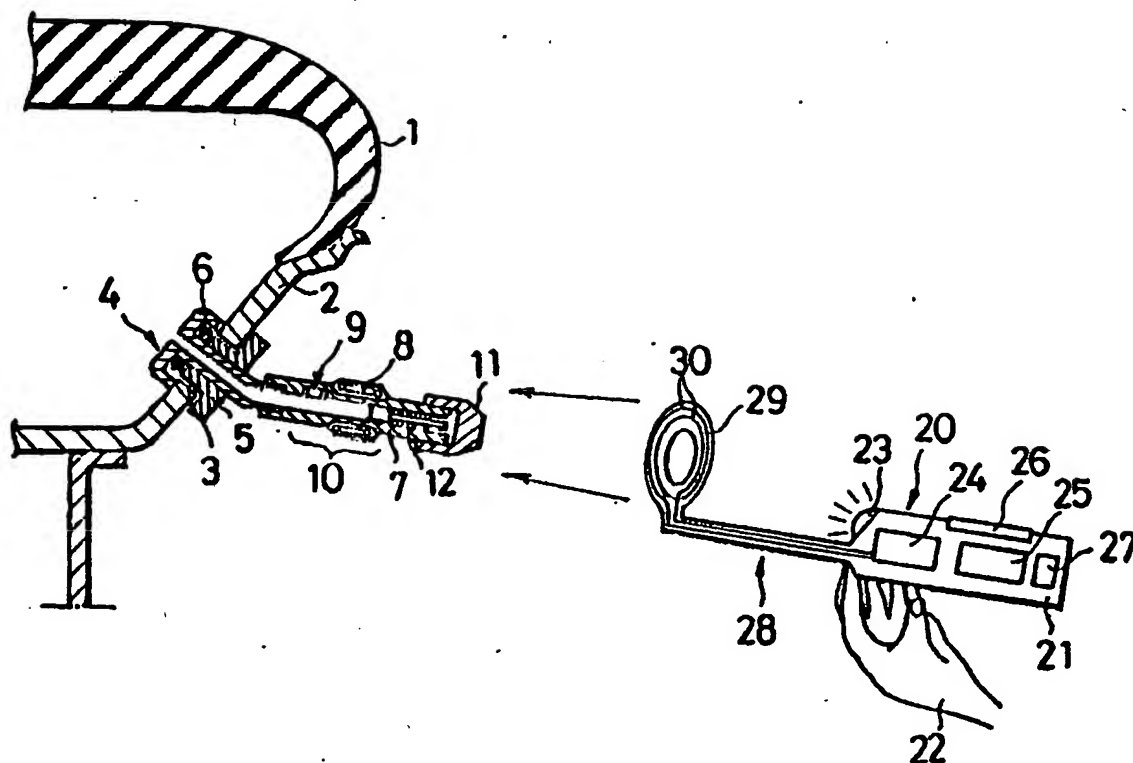


FIG. 2

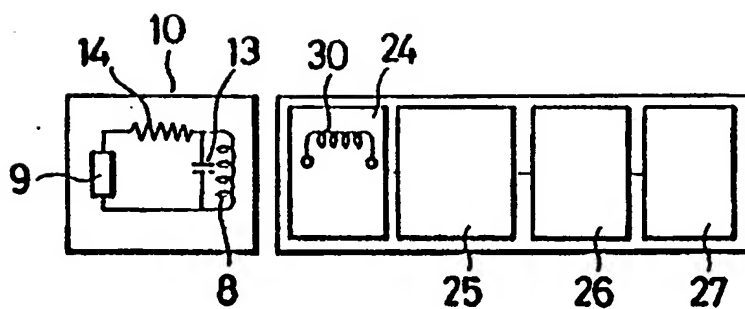


FIG. 3



FIG. 4

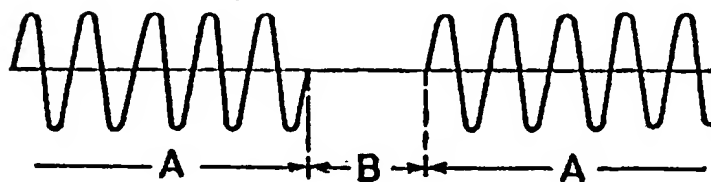


FIG. 5

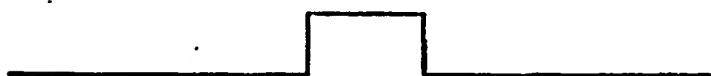


FIG. 6

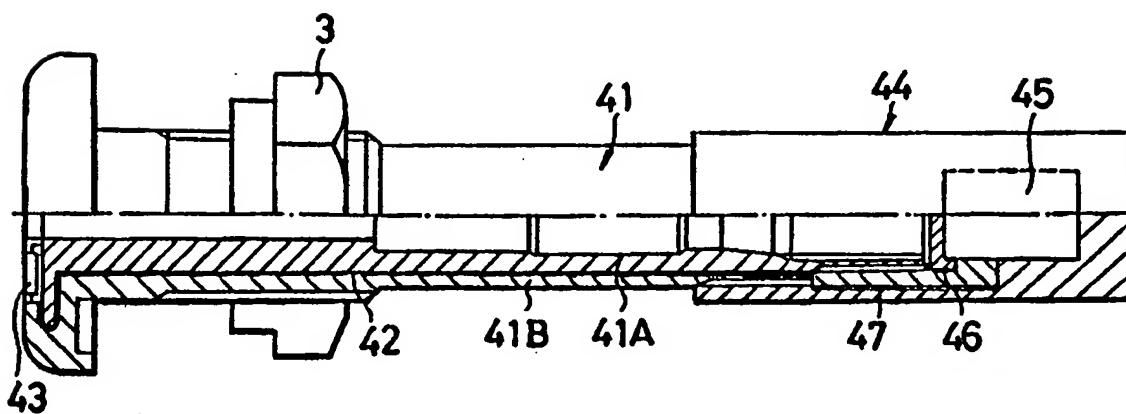


FIG. 7

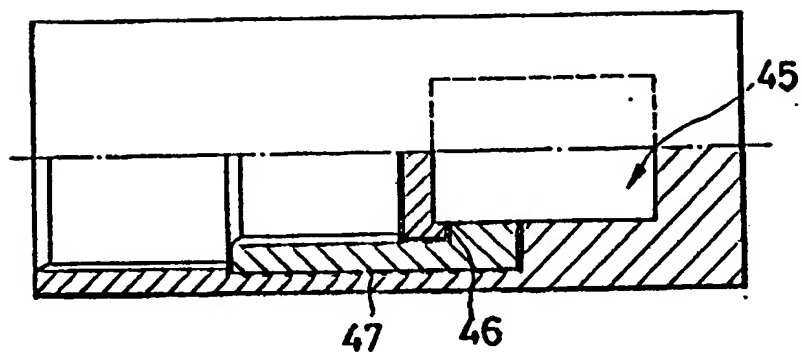


FIG. 8

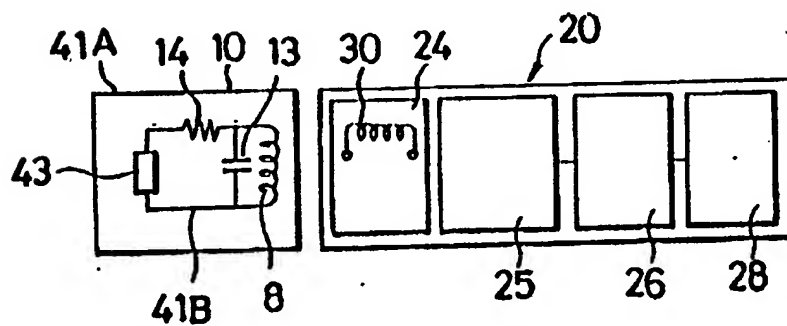


FIG. 9

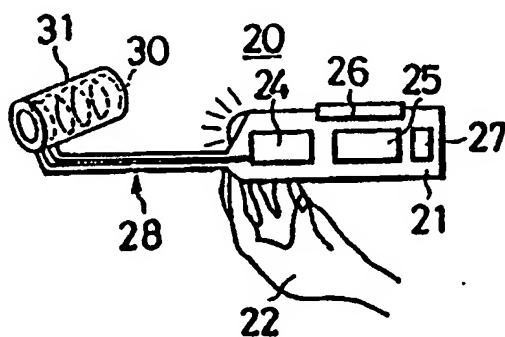




FIG. 10

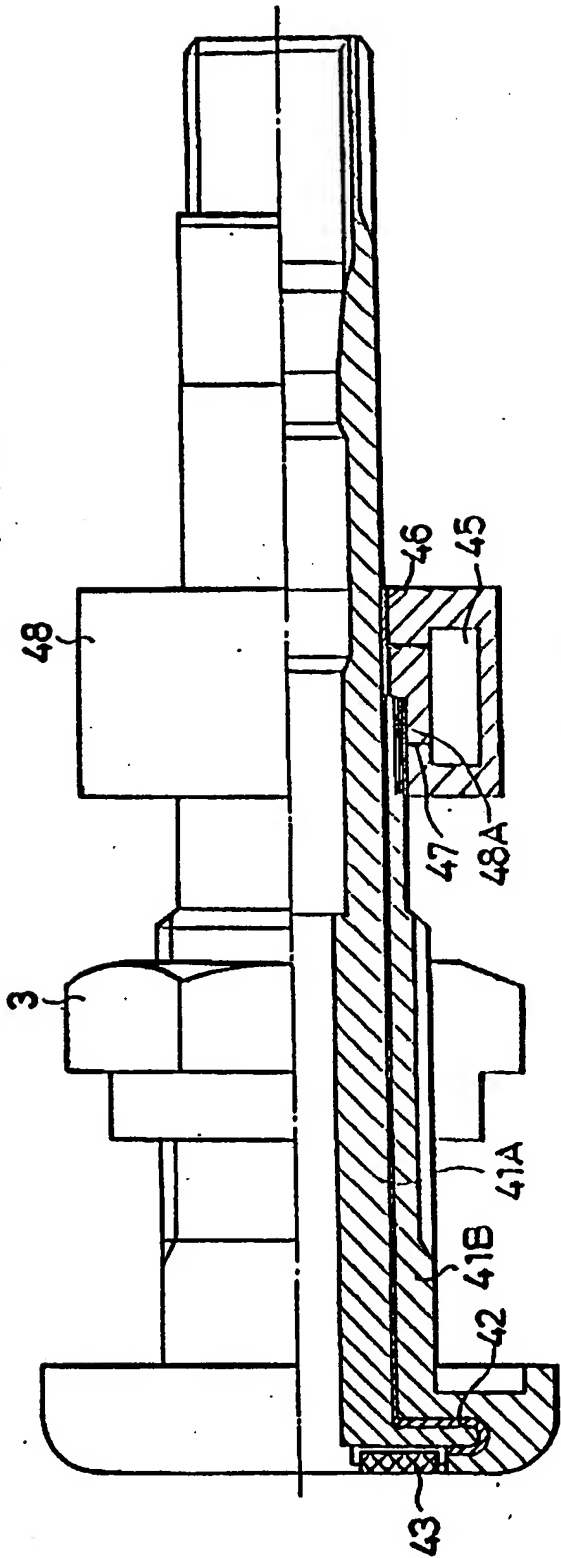


FIG. 11

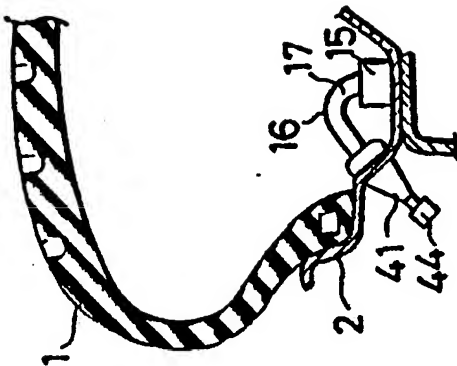


FIG. 12

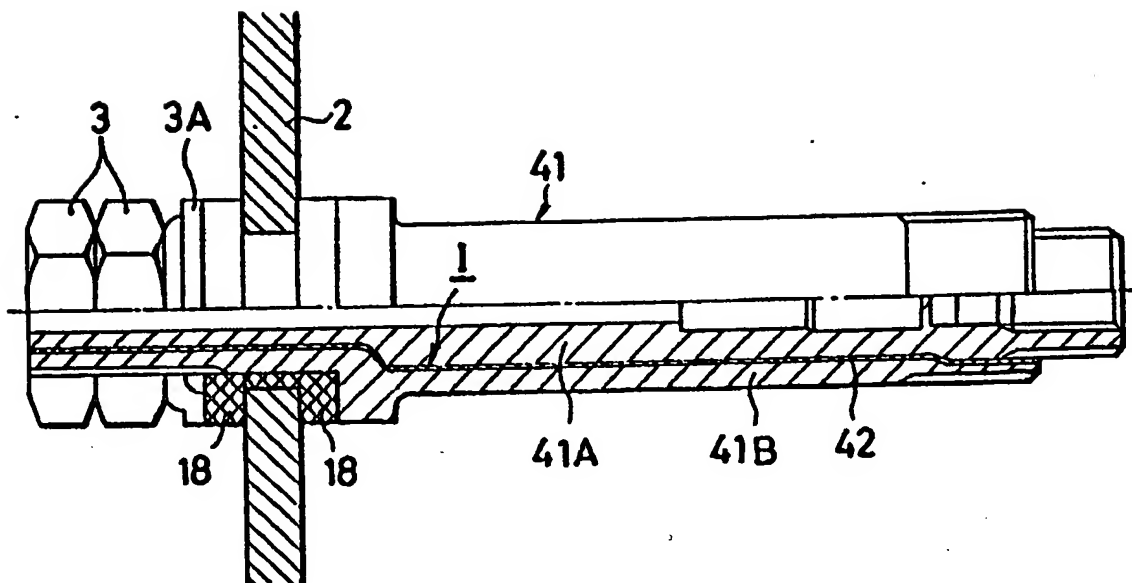


FIG. 13

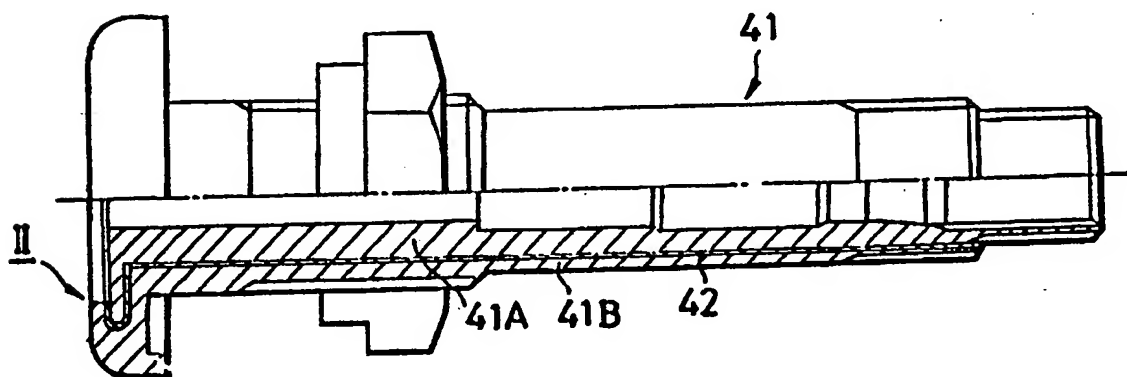


FIG. 14

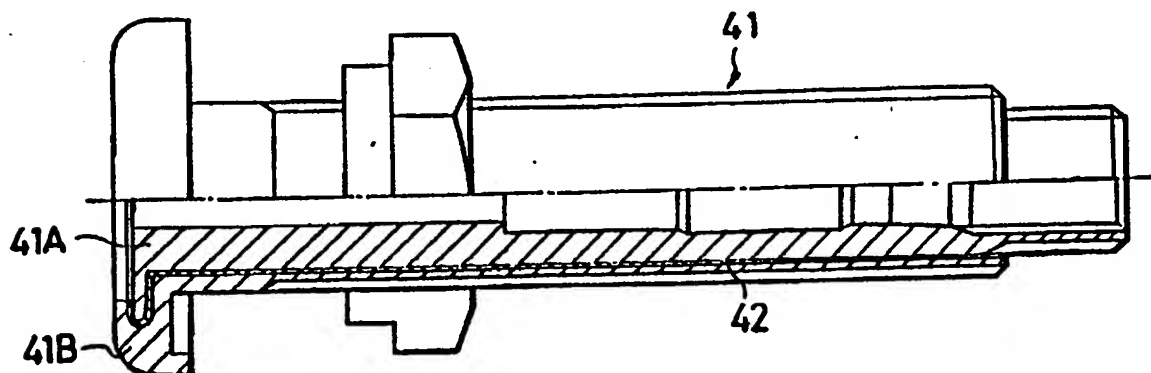


FIG. 15

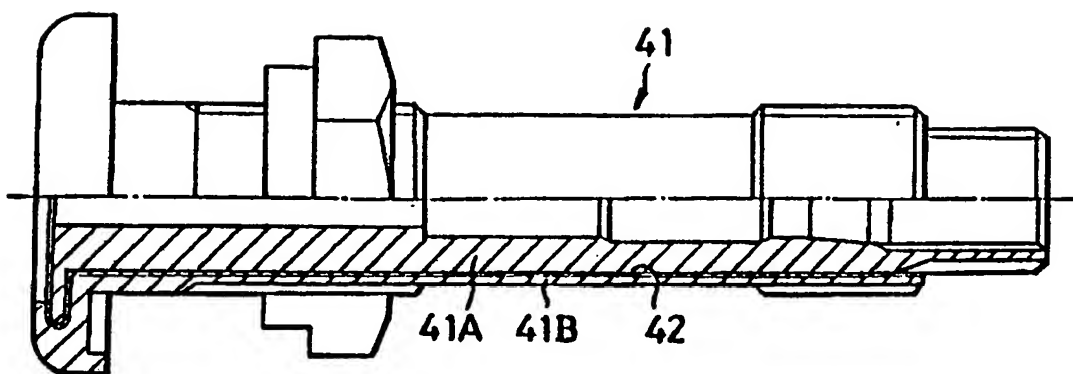


FIG. 16

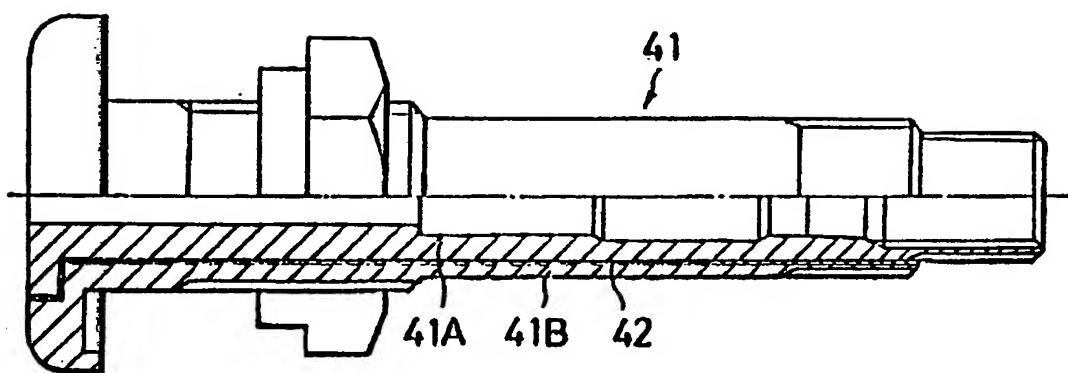


FIG. 17

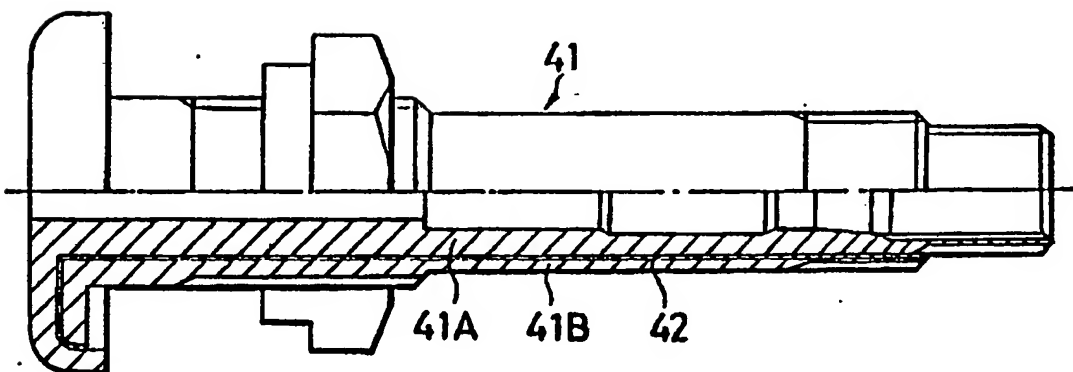


FIG. 18

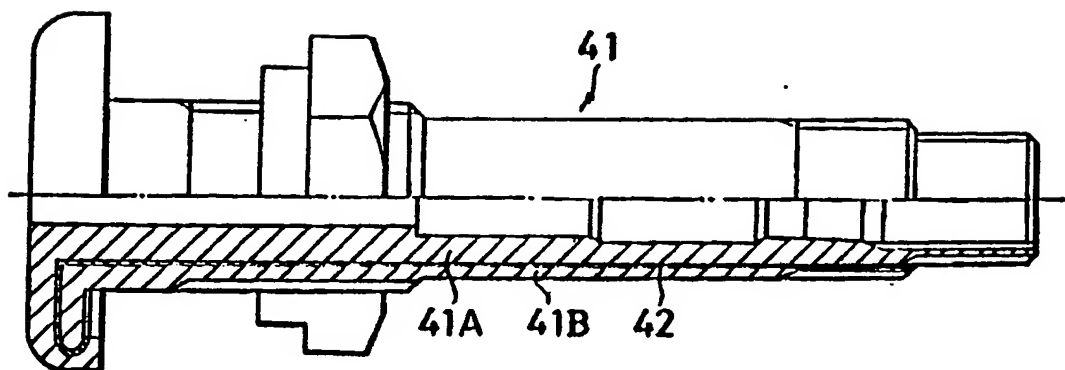


FIG. 19

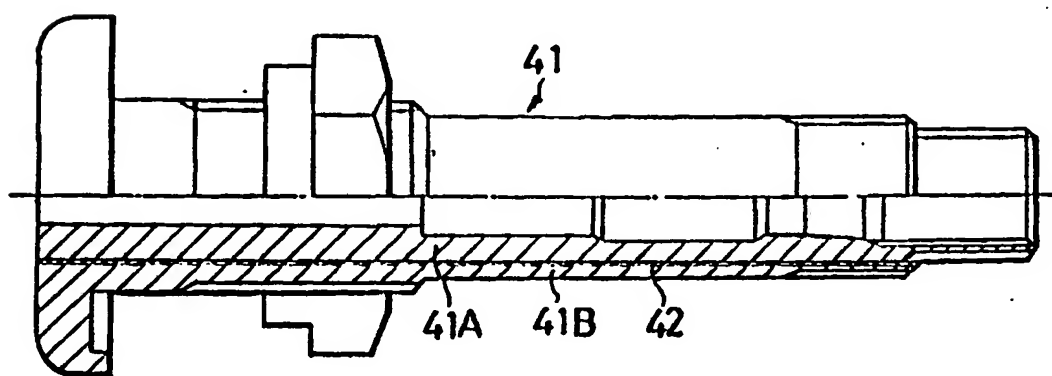


FIG. 20

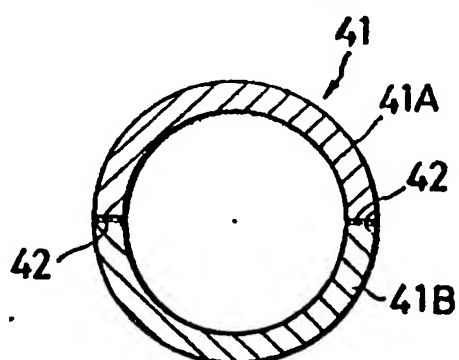


FIG. 21

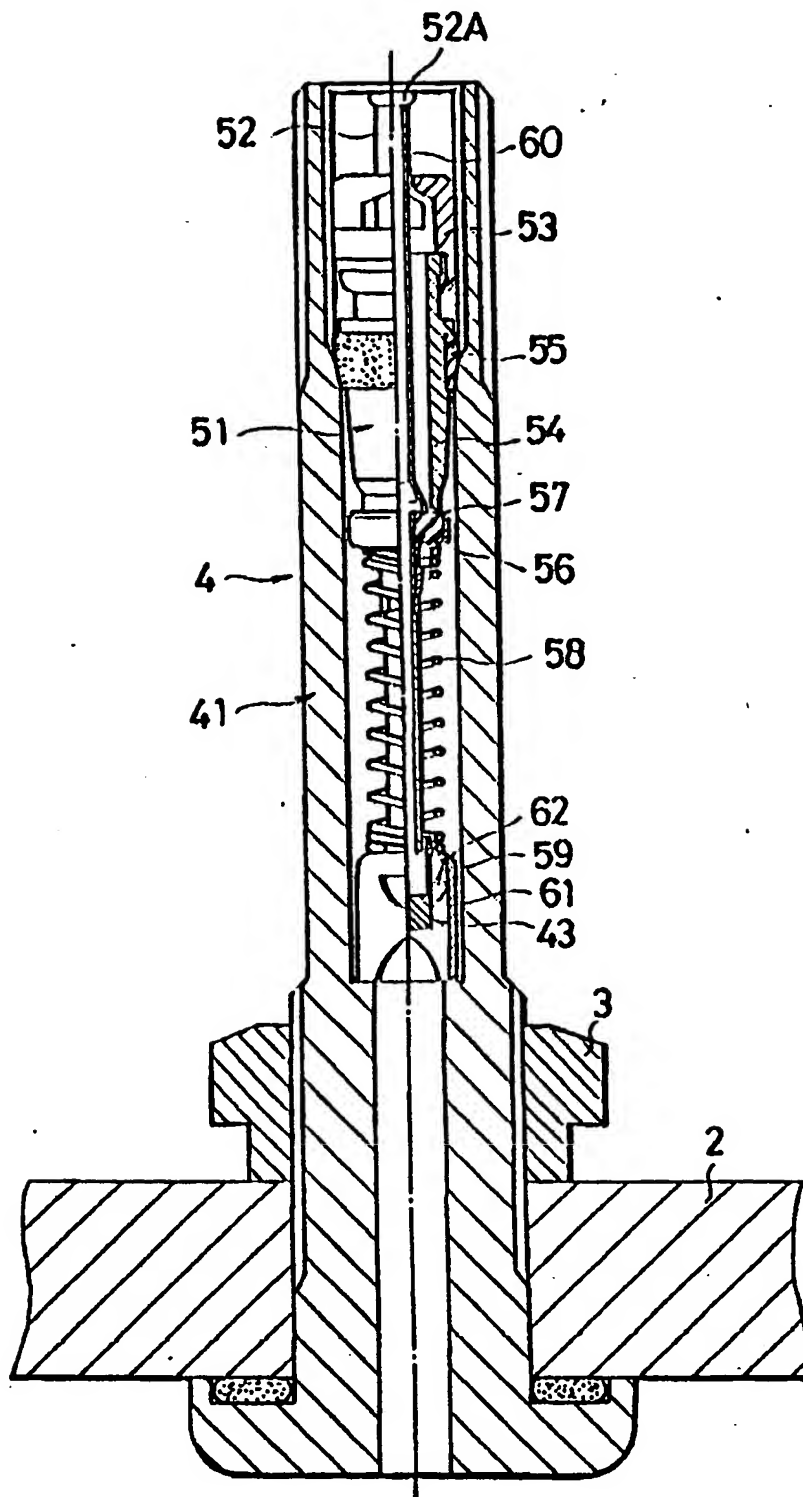


FIG. 22

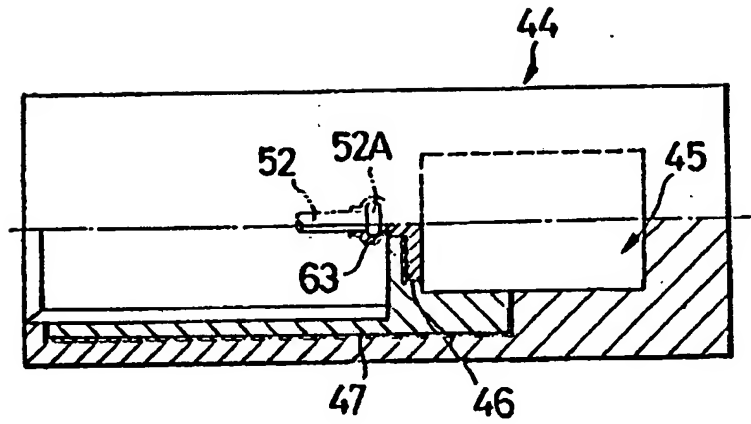


FIG. 23

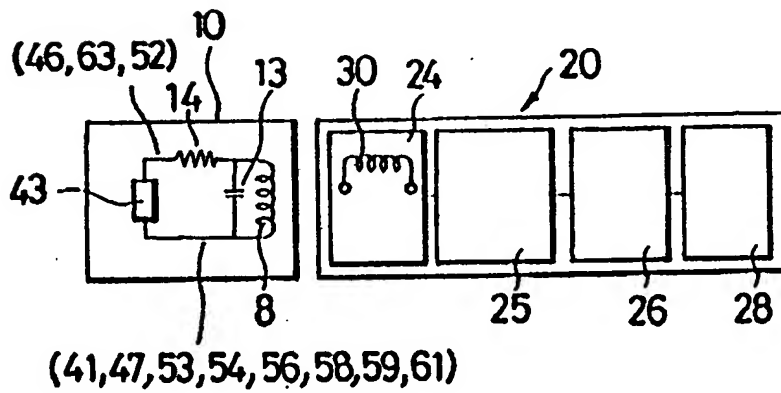


FIG. 24

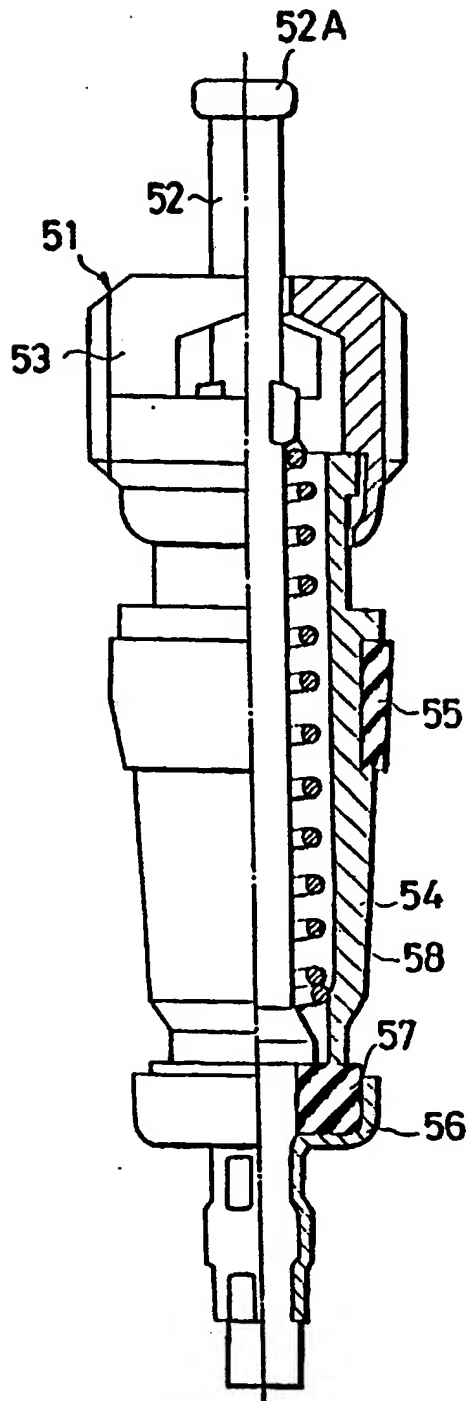
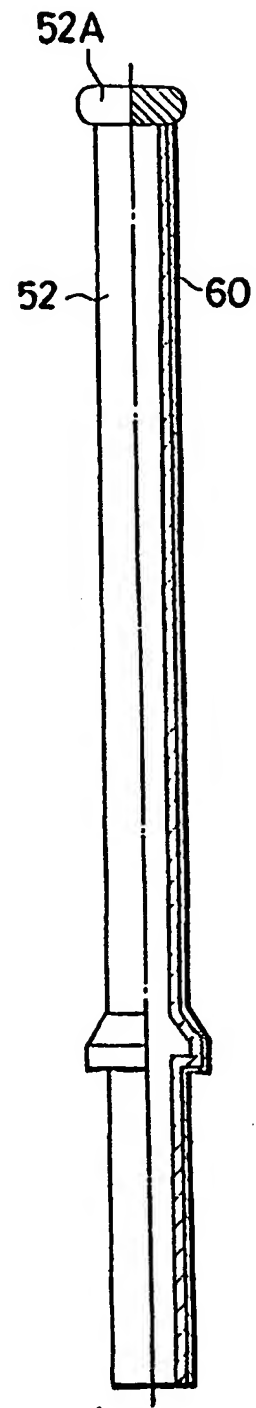


FIG. 25





DOCUMENTS CONSIDERED TO BE RELEVANT			EP 8811882.2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE - A1 - 2 824 992 (BRIDGESTONE) * Fig. 1,2,11; page 7, line 14 - page 8, paragraph 3 * --	1	B 60 C 23/02 G 01 L 17/00
A	AT - B - 381 477 (BOSCH) * Fig. 1; page 2, lines 32-48 * --	1	
A	AT - E - 7 172 (SOCIETE) * Fig. 1; page 3, line 44 - page 4, line 14 * --	1	
A	WO - A1 - 87/04 123 (BOSCH) * Abstract; fig. 1 * --	1	
A	DE - A - 2 260 522 (LUCAS) * Fig.; claims * ----	3,4	TECHNICAL FIELDS SEARCHED (Int. Cl.4) B 60 C 23/00 G 01 L 17/00
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 14-11-1988	Examiner BURGHARDT
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			